Potential and Actual Effects of Word Processing on Students' Creative Writing Process

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EXECUTIVE SUMMARY

The word processor is an effective tool for promoting students' creative writing. It is well documented that with the computer, students are more motivated to write; they are more willing to take risks in their writing; they tend to produce longer text; they edit more and thus produce fewer surface errors; and they are proud of the neatly printed copies of their writing. These effects alone are sufficient evidence that word processing is beneficial to students' writing. However, many strongly believe that this advanced technology has even **greater** potential to enhance students' overall quality of writing. For instance, with word processing, students should be able to concentrate more on the ideas, content, and their train of thought during composing and leave the mechanical and formatting part of their writing to a later stage. In addition, the flexible editing functions of the word processor can facilitate large-scale revision - for example, re-organizing the flow of the text - without the need to go through the drudgery of the re-copying process.

This study, however, shows that if the word processor is used alone and with little input from teachers, its potential can hardly be **fully** realized; in fact, some of its effects may be to impede students' text production. For instance, as students become more willing to take risks in starting their writing on the word processor, they tend to cut short or bypass the important stage of overall careful planning and organization of ideas. As well, during the actual composing stage, students are often attracted to tinkering with the surface features of the typed-in text on the screen instead of concentrating on their flow of thought. At the revision stage, adding new texts to the end of the original drafts and fixing surface errors such as spelling or word changes are often attempted, but high-level revision such as re-organizing or re-writing the text is seldom undertaken despite the powerful editing mechanism available on the computer.

This study demonstrates that in order to capitalize the full capabilities of the technology for enhancing students' writing skills, several conditions need to be met. First and foremost is **teachers' active involvement in the process** both as instructor and facilitator. For instance, students need instruction and guidance in writing strategies as well as word processing skills to

apply the strategies learned. To facilitate students' computer writing process, teachers have to constantly monitor students' interactions with the computer - for example, cautioning their students against the distraction of premature editing while composing, or prompting students to revise the computer-generated text beyond the surface level.

Another important condition is that the word processor should be employed in conjunction with, rather than in place of, **other writing tools**. For instance, when careful planning is necessary in such cases as report preparation, pen and paper may be a more convenient medium than the word processor for jotting down, crossing out, listing, or charting preliminary ideas or rough notes. When revising, pen and computer hardcopy seem to allow students to read, evaluate and revise their drafts more closely, thoroughly, objectively, and efficiently than with the keyboard and the screen. It is thus important to make printing easily accessible to students especially during the revision process. Aside from pen, paper and printers, there are computer writing tools specially designed for students who need help in generating or organizing their ideas before writing, or in revising their text after writing.

The third requirement is **availability of sufficient hardware**. Teachers have to have access to enough computers (and printers) in order to ensure that the word processor can be fully integrated rather than being simply an add-on piece of equipment in the classroom. Otherwise, it is difficult for teachers to pay close attention to the one or two students who work on the computer while teachers also attend to the rest of the class. Having writing lessons at a computer lab may be a viable option because computer writing can then become a major classroom activity and teachers can spend more time on and be more actively involved in their students' word processing and writing process. For some elementary school teachers, computer labs may not be readily available, or multiple group activities may be more desirable than a single class activity. In those cases, one or two more computers and/or a printer may also be helpful in enabling teachers to create a small-scale computer lab as an activity centre within the classroom. Teachers may then spend a block of time in their regular class period with the group of students who are working on the computers.

Last but not least, **teachers themselves need to be supported and facilitated**. For instance, teachers, particularly novice users, have to have time to familiarize themselves and experiment with the system. They also require information on and training in how to increase the impact of the technology on their students' learning. It is hoped that this study will serve as one source of information for teachers who are interested in using the computer as a tool to foster the creative process of writing for their students.

Contents

EXECUTIVE SUMMARY i
Table of Contents iii

Chapter 1 INTRODUCTION 1

Chapter 2 PLANNING 5
Observed Behaviours 5
Discussion 7
Suggested Interventions 11

Chapter 3 COMPOSING 13
Observed Behaviours 13
Discussion 15
Suggested Interventions 16

Chapter 4 REVISING 17
Observed Behaviours 17
Discussion 22
Suggested Interventions 25

Chapter 5 TEACHERS' INPUT IS IMPORTANT 29
Teachers as Instructors 30
Teachers as Facilitators 31
Conclusion 32

References 35

Chapter 1

INTRODUCTION

As indicated in numerous other surveys, a recent system-wide survey in Toronto schools reveals that word processing for creative writing is the most prevalent type of computer usage in our school system, especially at the elementary level (Yau, 1990). Many teachers in that survey praised the benefits their students gain from the medium. For instance, with the computer, students are motivated to write; they find it easier to edit; and they are proud of the neat and publishable copies of writing they produce on the word processor. While these advantages are sufficient to justify the use of word processing in writing class, it is believed that the technology has **greater** potential for enhancing students' creative writing skills.

In an earlier study also conducted at the Toronto Board, Writing with Microcomputers in the Elementary Grades: Process, Roles, Attitudes, and Products (Larter, Braganca, & Rukavina, 1987), it is clearly stated that the use of microcomputers in elementary grades is expected to facilitate the Ministry and the Board philosophy of teaching writing to children.

> Documents published by the Ontario Ministry of Education ... and the Language Study Centre of the Toronto Board of Education ... provide a general philosophy of teaching writing that emphasizes doing a lot of writing, experimentation, self-editing, revision, student-teacher conferences, individualization, peer evaluation, and edited, typed, displayed material. The literature on the use of microcomputers in education, ..., contains a great deal of anecdotal evidence that suggests that this philosophy of teaching writing can be facilitated by using microcomputers in elementary classrooms. (p.1)

Other recent literature also discusses various ways in which computers are expected to enhance students' creative writing process (Hunter, 1988; Miller-Jacobs, 1987; Morocco & Neuman, 1986; MacArthur, 1988; Schaeffer, 1987; Neale, Morocco, & Dalton, 1987). For example:

1. computers motivate students, especially reluctant writers, to take risks and experiment in their writing;

2. computers stimulate students to write longer texts;

3. because of the ease of making changes, computers allow students to concentrate on content first and mechanical and stylistic concerns later; and

4. computers permit flexible editing of text, and thus encourage students to revise their text more and at a higher level.

While some of the above claims (such as 1 and 2) have been confirmed by research, other advantages (such as 3 and 4) do not seem to happen spontaneously among students. As will be discussed in this paper, a close examination of the interactions between word processing and the writing process indicates that if the technology is used planlessly and with little teacher intervention, its capabilities can hardly be fully realized. impact on students' writing will be limited; in some instances, its effects may even be undesirable. It is thus postulated that in order to realize the full potential of the word processor for students' writing, teachers must first understand the capabilities as well as the limitations of the technology, and, in turn, take necessary measures to maximize its benefits for and minimize its negative side effects on their students' creative writing process.

To this end, the present study examines the subtle impact of word processing on students' text production process: i.e. how the word processor, **when used alone**[1], influences the way students approach their writing tasks. The emphasis is on the interactive effects on the process of writing, rather than its global impact on the overall writing results, as many empirical studies have already compared the writing products produced with different media.

To address the above questions, the three conventional writing stages - (i) planning, (ii) composing, and (iii) editing and revising - will be employed as the framework of analysis. It is understood that these three writing processes do not necessarily follow each other in a linear fashion, and that they can occur in a recursive pattern (Curtis, 1988; Parson, 1985). However, for a more systematic and in-depth understanding of the relationship between word processing and the process of text production, the three writing stages will be dealt with in separate chapters.

SOURCES OF INFORMATION

Two major sources of information were employed in this study - (i) classroom observation, and (ii) existing research.

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1. That is, with little or no active involvement of the teachers, or without combining the use of other writing media such as pen, paper or printed hardcopy.

(I) Classroom Observation

Naturalistic observation is an important component in this study. In order to understand how computers interact with students' writing process, it is crucial to observe both their writing as well as their word processing behaviours in a natural setting. For this reason, a group of elementary school (mostly junior level) teachers were invited to be the participant observers.

There were three reasons for having teachers conduct the observation as opposed to outside observers. First, the presence of an outside observer is likely to affect students' normal behaviour. Second, we attempted to observe a large sample of students for an extended period of time, instead of a selected few over a short time span; it was thus more practical to enlist the teachers' co-operation than to have many observers in different classrooms for the whole school year. Thirdly, we believe that teachers themselves can benefit from such an experience by making themselves more aware of the teaching and learning process in classrooms (Atwell, 1985). "As researchers, teachers can take a much more professional role in their own development" (Ragsdale, 1988, p.251).

The recruited teachers were offered a brief in-service session on the purpose of the project and on some of the basic observational techniques. They were also provided with a kit containing important guidelines for their observational tasks, daily log sheets and journal forms. The teachers were encouraged to record their observations on the log sheets on a regular basis and to use the journal forms for more detailed descriptions. The teachers' journals were then collected at a two-month interval. Altogether three sets of journals were gathered from each participant teacher. For the first observational journals, the teachers were encouraged to document any occurrences related to their students' use of word processing that they did not anticipate; they were, however, not informed about specific kinds of behaviours or outcomes to look out for based on existing literature and research. The purpose was to avoid any preconceptions that might confine the teachers' observations to areas that the author had already identified. Furthermore, for the purpose of the study, teachers were asked to observe their students' spontaneous behaviours without their interventions, at least not before they had the chance to observe. After collecting the first journals, the author visited the teachers at their respective schools, gave them feedback on their first journals, and offered them more hints and directions when necessary.

We were cognizant of some limitations of having teachers as participant observers. First, not all teachers could or were willing to take part in the classroom observation. For instance, there were a few teachers who could not participate because of the lack of equipment

in their classrooms. There were other teachers who chose not to be involved because they saw such observational tasks as a hindrance to their classroom teaching. As a result, the number of teacher participants was nine instead of the 28 that was the original target.

For those who did participate, many noted that it was not always easy to find time to observe students working at the computers while keeping the rest of the class at work. Similar problems were indeed reported by other researchers who had classroom teachers as their observers (Ragsdale, 1988). These researchers found that because of the time factor and the various ongoing activities in class, teachers sometimes had difficulty remaining alert observers. In addition, some of our teachers encountered difficulties, such as malfunctions with their computers, which consequently reduced their observational opportunity.

Aside from the logistic problems, there were other intervening factors that might have affected the observational outcomes. These factors include teachers' own level of computer use, their comfort level with computers, their expectations about how word processors should be used in class[2], the kinds of software, the word processing environment[3], and the students' computer literacy level. All these variables could influence the teachers' perceptions. However, as Ragsdale (1988) points out, "... the wide range of teacher backgrounds and teaching environments, often seen as hampering research by introducing more variation in results, can be seen as an advantage when a variety of factors needs to be considered. Since the identification of the important questions is still incomplete, a variety of inputs from teachers can only help make the identification more comprehensive" (p.251).

(II) Research Review

While the teachers' observations provide many interesting findings and perspectives, it is important to substantiate and to supplement their findings with available empirical studies. A cursory examination of the existing literature reveals that relatively little has been done on the effects of word processing on writing process. Of the studies that are available, few were conducted with regular classroom students (Morton, Lindsay & Roche, 1989). Instead, most of the empirical studies were targetted at learning disabled students, post-secondary school students, or adult professional writers. Nevertheless, many of the research findings do offer interesting insights into our current research, and, hence, they will be included in this report.

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2. Teachers may have different expectations for the role of word processors in supporting writing. Some teachers "viewed word processing as a publishing tool and had students use it mainly to transcribe writing and print out and illustrate drafts." Some focus on "having students compose and develop ideas." Other teachers focus on "revision processes in writing and emphasized the machine's role in supporting major additions and revisions, ..." (Neale, Morocco, Dalton, p.22).

3. For example: the physical set-up, accessibility to printing, individual use versus collaborative work, and the amount of teachers' input.

Chapter 2

PLANNING

Good writing practice usually entails a planning stage, in which two main cognitive activities take place - brainstorming of ideas, and organizing the overall content structure. Such planning is often seen as the pre-writing stage, since generally planning is the first step in one's writing task - even though the original plans will often be modified or expanded during the composing or the revising stage. For some writers or in some situations planning may not occur until the actual writing stage (Curtis, 1988; Parson, 1985). Nonetheless, written plans in one form or another are important guides to "keep [writers] themselves on task, to keep track of their goals, and to explore ideas" (Haas, 1989, p.185). The importance of developing young students' habits of planning prior to actual writing has been reiterated in recent writing literature.

> There is some reason to believe that the activity of organizing is particularly important in teaching children to write. Even though children have a much smaller body of 'world knowledge' to deal with, their "main problem with content is getting access to, and giving order to, the knowledge they have." (Bereiter and Scardamalia, 1982). This suggests that the quality of children's writing may be less influenced by their subject knowledge than by their organizational skills. (Hunter, 1988, pp.5-6)

The question is: does word processing enhance or facilitate the planning process?

Observed Behaviours

According to Miller-Jacobs in her teachers' guide, A Process Approach to Writing with a Computer (1987), word processors can facilitate students' planning.

> Since words written with a word processor are easily erased and moved, students experience more freedom in expressing their ideas. Ideas written on the computer are more concrete and can be selected easier than ideas floating around inside the brain. (p.1)

Unfortunately, due to the limited number of computers our teachers have in their classrooms, most teachers were forced to have their students plan their writing without the computer. Therefore, there is little in our teachers' observational journals that touches on the topic of word processing and planning. There are, however, two studies on school-age children which discuss briefly their subjects' pre-writing behaviours when word processing was used. One of them is Morocco and Newman's study (1986) on learning disabled (LD) students. The two researchers conducted a study with 11 fifth- and sixth-grade LD students who had approximately two years of word processing experience. It was found that as a result of word processing, the LD students were more willing to take risks and experiment as they began to write.

> ... the word processor can be a more effective tool for brainstorming than a pencil. Our observations suggest that when writing on a computer, students are willing to make more than one attempt to begin a piece of writing, erasing as they change their minds or think of additional ideas.... they seemed to be more willing to take risks in beginning to write. (Morocco & Neuman, 1986, p.244)

While willingness to experiment or take risks is an important start for creative writing, strictly speaking it is not planning per se. In a one-year study of 80 seventh-grade students, Dalton and Hannafin (1987) did observe students' planning behaviour when computers were used. In that study the subjects in both the word processing treatment group and the conventional writing group were encouraged to complete pre-writing planning activities, which were supposed to include the development of an outline and a skeletal rough draft by hand before their composition. Interestingly, it was found that students in the word processing group were <u>less</u> likely than their counterparts in the control group to go through the careful planning stage prior to their actual writing.

While these two studies offer glimpses of students' pre-writing behaviours with the word processors, neither examined the issue in depth. A review of the existing literature indicates that little has been done to examine specifically how word processing affects the planning process. The few studies available are all on college/university students or experienced writers. Yet, this handful of studies offer interesting insights into the role of word processors at this particular stage of writing, and the findings may bear important implications for the pre-writing process of students.

Bridwell, Nancarrow and Ross (1984) in their close observations of eight PhD candidates noted that their subjects either found it hard to plan on the computer, or felt "that they could ignore the need to plan on paper and simply compose to see the shape of their ideas" (p.393). The findings were corroborated in another study by Bridwell and her other

colleagues (1987), who studied the word processing and writing behaviours of eight graduate teaching associates. Again, these writers either found it difficult to plan on the screen and had to resort to pen and paper, or they cut short their initial planning and started writing to see how their ideas developed.

Lutz in her study of a group of professional and experienced writers (1987) also noted that the subjects tended to plan less when writing on the computer than with pen and paper. Indeed, when word processing was used, more than half of the participants began their writing without a plan and were willing to just "see how it [the text] would go". But with pen and paper, all but one reportedly began the assignments with a plan. They felt the need to plan more on paper.

A parallel finding was reported in one of Haas' earlier studies (1987). More recently, Haas (1989) examined specifically and systematically the role of word processing on writers' planning process - both in terms of the amount of planning and the quality of planning prior to actual writing. Two subject groups (10 each) of experienced writers and university freshmen were included, and think-aloud protocol methodology with the help of audio tapes was used to probe the planning behaviour of their subjects. The results of this empirical study show that when the subjects in either group were using word processing alone, there was (i) significantly less initial planning, (ii) significantly less high-level or conceptual planning, and (iii) significantly more localized or sequential planning than when they were using pen and paper. That is, even if some planning was undertaken on the computer, the type of planning was at the more superficial or localized level rather than at the global and conceptual level.

Discussion

Although most of the findings cited above are mainly based on the experience of adult writers, it has important implications for the teaching of school students, who seldom plan or plan enough for their writing even with pen and paper. There are perhaps three possible explanations for the diminished planning with computers: (1) psychological factors, (2) difficulty of planning with the keyboard and screen, and (3) writers' willingness to take risks and experiment on the computer.

(1) Psychological Effects

According to some experienced writers, the computer hardware itself has the psychological effect of luring them to start writing sooner than they normally do with pen and

paper. For instance, a subject in Haas' study (1987) reported that when writing on paper, "he feels license to just pick up the pencil and then sit and think - plan, if you will; he engages the task by picking up the pencil, but doesn't produce text right away." But when writing on a computer "there is no comparable act to become engaged with the task without actually beginning to type - 'I don't feel like I can just sit and think with my hands on the keyboard - I feel like I have to start typing'" (Haas, 1987, p.10).

Ragsdale (1988) has made a similar observation about his own interaction with the computer.

> ... the lure of the keyboard and flashing cursor is still a strong attraction to me. Planning is usually limited to pausing a few moments, while the terminal warms up, with fingers on the keys, thinking about what it is that needs to be inflicted on unsuspecting readers. In other words, the use of computers is, in my personal case, a deterrent to the planning process.

One of the writers in Bridwell-Bowles et al. study (1987) also reported that the computer tempted her to write sometimes so quickly that she was "not spending enough time in a gestation period" (p.103). As well, the researchers in the study noticed that those writers who spent a long time developing planning notes in the handwritten session moved more quickly into producing text during the word processing session. An explanation these writers had was that the computer encouraged them to begin writing because their ideas looked "polished" on the screen (Bridwell-Bowles et al., 1987).

(2) Difficulty of Planning on the Computer

Aside from the psychological effect, some researchers argue that the computer has its inherent restrictions that inhibit planning, especially conceptual planning. These restrictions have to do with (a) the configuration of the word processor itself, and (b) the limited visual display on the screen.

(a) Word Processing Configuration

During planning, ideas are very often generated in a dynamic and recursive pattern rather than in a sequential or linear fashion. Writers may have to jot their ideas in note forms and to link the relationship of ideas graphically using arrows, circles, trees, etc., instead of expressing planning ideas as continuous texts. However, as Haas (1989) points out, conventional word processors are not configured for such activities as creating "arrows, boxes, or other diagrammatic devices for displaying conceptual relationships among notes." In fact, in both of Bridwell's studies (1984, 1987), this restriction was found to be an obstacle for

some of their writers who relied on diagrams and notes for planning, and had to resort to pen and paper for this step.

Even for those who could plan almost exclusively in words on the screen, Bridwell-Bowles et al. (1987) noted that the format of their plans altered from the note or outlining form to complete and connected sentences. Similarly, Haas (1989) noticed that writers who regularly took planning notes were also "drawn into text production" on the word processor. According to Haas, the difficulty in creating gist-like or chunked notes on the computer often turns writers to produce phrases or even sentences of written text instead. It is not yet known whether such change in planning format is conducive or inhibitive to planning, although a writer in Bridwell-Bowles et al. study (1987) indicated that she was pleased with the adjustment: "Just getting thoughts down on the screen helped me get into the writing" (p.91).

(b) Limited Visual Display

The visual display itself also poses some hindrance to conceptual planning. According to Haas, "... small computer displays which show only a portion of the text at once might encourage writers to focus their attention on parts of text within a screen rather than think about concerns that extend across screens" (p.185). As a result, writers tend to do more word- and sentence-level planning - for example, concerns of word choice, sentence structure, punctuation and other surface-level options - on the word processor, rather than overall conceptual planning in terms of text organization, or development of a thesis or argument.

(3) More Willing to Take Risks and Experiment

Some researchers argue that with word processing the approach to writing may have to alter (Curtis, 1988). That is, one may cut short or replace advance planning with more risk taking and experimentation with their writing because text can be easily changed on the computer at any time (Dalton & Hannafin, 1987; Bridwell-Bowles et al., 1987). On the other hand, with pen and paper, because it is more time consuming and tedious to make changes, writers tend to spend more time planning to save themselves recopying later. As a subject in Haas' study (1989) put it, "you can jump right in because it's easy to delete or change something if you don't like it." His experiment indeed shows that although the amount and proportion of planning was less in the word processing condition, the writing sessions and texts under this condition were not generally shorter. According to Haas, it is possible that writers make up for decreased planning by relying on later revisions to perfect their ideas.

Nevertheless, one may still question if willingness to take risks or experiment can compensate for less planning or for the difficulty writers encounter in planning on screen. To answer this, further research on the impact of decreased planning on text quality is needed. As no research evidence is yet available to verify this, one may consider the question in terms of one's style of writing and the kinds of writing concerned.

As shown in Bridwell-Bowles et al. study (1987), some writers need to see the emerging text as a cue for their planning process. For them, the screen display and keyboard allow them to see their ideas quickly. Yet, the researchers pointed out that not all writers who plan and write at the same time necessarily benefit from such a process. "Those who used the forward progress of their words appearing on paper as 'discovery drafts' were least pleased. These writers were accustomed to constant re-reading and planning as they wrote and were bothered by the never-never land of the computer's memory. Unless they could see their writing, what they had composed was lost as an aid to invention and discovery" (p.103). Another writer who was also used to plan and compose at the same time found it difficult to "drag the text around on the screen the way he would if he could draw circles and arrows and trees [on paper]" (p.102).

With regard to students, whether more risk taking can make up for less planning seems to depend heavily on the kinds of writing involved. For story writing, especially at the elementary school level, some students may be more productive and creative by starting right off and letting their thoughts flow as they write. After all, it is better for reluctant student writers to take risks than to hesitate to write. As Parson (1985) puts it, "For writers with little or no track record of success, who are typically over-concerned with error and 'getting-it-all-right-the-first-time', the computer removes the terrible anxiety of writing" (p.27). In this case, word processing facilitates the process. However, not all writing activities lend themselves to such free and spontaneous forms of discovery writing. There are occasions - for example preparing a research report - when advance planning is necessary. Moreover, not all students feel comfortable composing without a plan or guideline. In these situations when initial planning is crucial or desirable, the question is whether the computer can be used to facilitate the process.

Suggested Interventions

Some writing experts have proposed ways of using the computer to assist students with initial planning. Miller-Jacobs, in her teachers' guide (1987), suggests that teachers can create on the word processor files containing lists of possible ideas, descriptive words, or questions. To each list begun by the teachers, students can add their own ideas or questions that relate to the writing in mind. The purpose is to help students select and generate ideas before they begin to write. This method of support is particularly useful for young and special needs students.

There are also more sophisticated prompting programs specifically designed to help students not only in idea generation but also in idea organization. These dedicated systems, sometimes known as "idea processors", attempt to make the cognitive processes involved in planning explicit, in order to lead users through the various "getting-started" activities (Oates and Oates, 1987). For example, one type of idea processor is for fiction writing, and offers "freewriting" activities but restricts users from backspacing or erasing while freewriting. The intent is to force one to "move forward without interrupting one's flow of ideas until a later stage...." Another kind of idea processor is for non-fiction ideas, which provides an outlining program and prompts to assist users in deciding on an organizational structure or in identifying key ideas: for example, answering who, what, where, why and when questions, or prompting users to define, compare, contrast, and argue for or against the topic (Oates and Oates, 1987; Smye, 1988).

These computer-assisted idea lists or idea processors are beneficial for students who need help to stimulate and prompt their brainstorming and planning process. But for those who are able to plan independently, pen and paper may be more be facilitating than the computer. As discussed earlier, the very physical configurations of the word processor pose some constraints to the free planning process. On the other hand, with pen and paper, ideas can be easily jotted or listed and can then be easily linked to one another freely with lines, arrows or circles. Some of our teacher observers reported that intuitively they found it more productive for their students to do the planning off the computer. In Parson's study (1985), a secondary school student who used the word processor for his writing made the following comment about his pre-writing activities:

> I still prefer to do pre-writing activities by hand because it feels better. I just wrote down any major sections and ideas I didn't want to forget. Then I wrote rough draft on the computer....

... in fact, my typing is faster than my handwriting, but I just relate better somehow to the paper for a rough draft. It seems easier to cross things out than push buttons to change things. (p.41)

Chapter 3

COMPOSING

The word processor can be an effective tool for facilitating the actual writing process. [4] Because of the ease of making changes on computers, writers can concentrate more on the idea content and substance while leaving mechanics and formatting to a later stage. This is a desirable feature, as it has been strongly recommended that writers should focus on their train of thought and avoid editing the language, syntax, or mechanics of their developing text. According to writing researchers, allowing one's mind to wander after each sentence or pair of sentences would interrupt the flow of one's thought, and the usual pauses "obstruct their fluency and, more importantly, dilute their concentration" (Marcus & Blau, 1983; Parson 1985). Indeed, it is clearly stated in the Ministry guideline that "revision and proofreading should not precede the development of fluency" (Ontario Ministry of Education, 1982, p.3).

Observed Behaviours

Both our teachers' observations and previous research studies have, however, indicated that the above-mentioned positive effect does not seem to emerge automatically. Indeed, it has been found that the reverse is true in many instances. It is true that on the computer, students tend to be more focused on their tasks, as reported by some of our teacher observers. However, a closer examination shows that often part of their attention during the composing stage was on editing. In fact, one of the recurring findings in both our teacher observers' journals and the available research is the strong tendency for students and even adult writers to attempt premature or "in-process" editing when the computer is used (Smye, 1988; Ragsdale, 1988).

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4. However, it should be noted that some teachers used the word processor only as a publishing tool (for producing neat copies), but not for writing or revising. One teacher pointed out that owing to the limited access to computers, the latter could only be used for producing "good" copy for display or publishing; while composing, editing or revising had to be done before the students arrived at the computer. Another teacher preferred to have his students pre-plan and draft on paper and use the computer for formatting the final copy - e.g. for producing title pages, newspaper formats, or producing other formats or fonts, etc.

For instance, seven of our nine teacher observers reported that when composing on computers, their students attempted a lot more surface editing - such as, spelling, punctuation, and vocabulary - than when writing longhand. Some of these teachers expressed their concern that this premature editing might have interfered with the creativity of the piece of writing.

> I found that more time was spent on editing and correcting than on subject flow and that it took them much longer to produce a story.... and the amount of work being produced was minimal.

Another teacher recorded the following about two of her students who were reportedly good writers.

> During writing stage ... approximately one word per line the students erased, looked up [in the dictionary] or asked me. When they were not using the computer, they would not have taken this kind of time with spelling; they would have been less inhibited. It's slowing down the flow of ideas. However, the finished product is better but the quantity is less.

The same teacher also documented this scenario when a pair of students were writing together.

- "You forgot the capital" - erase, and search for the shift key.
- "It all started one Hallowen night"
- "Let's change that to 'It all started one scary Hallowen night'"
- "That sounds better."

Some teachers commented that mechanically, at least, the product was better. In fact, a teacher was delighted to see that there was much more re-reading which ultimately led to a better product, even though she realized that this would have better been done at a later stage.

Our teachers' observations can further be substantiated by a number of research studies. Daiute (1986) conducted an experimental study with a group of grade 7-9 students to determine the power of computer tools for beginning writers. Among her many findings, Daiute noticed that even though the students were instructed to compose without worrying about mechanical errors, they still spent time using editing commands to make changes in mechanics, such as spelling, as they composed on the word processor.

A similar finding is evident among the LD students in Graham and MacArthur's study (1988). When using the word processor to compose, their subjects were inclined to do most of the changes - usually minor surface adjustments such as spelling and word changes - while composing their initial drafts. In contrast, when writing the first drafts with pen and paper, these same students made relatively few changes to their developing text, and most of the changes were made in the second draft.

Comparable composing and word processing behaviours have also been observed among adult writers in the two studies conducted by Bridwell and her colleagues (1984; 1987): "the lure of the gadgetry, the compulsive need to correct as they go along." Some of the subjects even commented that "they had to force themselves not to tinker as they went along in order to build up forward momentum" (Bridwell et al., 1984, p.393). In fact, it was noted that one of the subjects had spent much of his time correcting and editing planning notes. Morocco and Neuman (1986) even found that some teachers were tempted to have their students correct errors or formats while composing on the screen:

> The accessibility of the child's writing, together with the editing features of the word processor, can make editing and revising of text too attractive. Several teachers felt the word processor stimulated them to ask too much of students in the way of neat and correct format, and to ask it too early in the writing process. (p.246)

Discussion

The urge to edit or revise when composing on the computer can perhaps be attributed to two hardware related factors. The first has to do with the ease of making changes afforded by the editing capability of word processors. Nearly all experienced writers in the Bridwell et al. study (1984) reported that they edited more because it is so easy to do with a word processor.

The other possible reason pertains to the fact that surface errors are more visible on the screen than in handwritten form. A few quotations from various researchers will illustrate the point.

- Because errors are even more glaring on the monitor than on paper, it is tempting to ask students to correct their text where they need to be expanding and discovering their ideas. (Morocco & Neuman, 1986, p.246)

- I just can't stand to see mistakes on the screen when I am writing. (Marcus & Blau, 1983, p.13)

- ... the physical clarity of the text. Since the texts created with the word processor appear in neatly-typed letters, superficial problems may be easier to identify than they are when the text is handwritten. (Daiute, 1986, p.156)

Ragsdale (1988) in his report noted another interesting observation:

> One user told me that he saw word processing as interfering with his concentration, particularly when he created a first draft. Whenever he paused it was as though the cursor, blinking at the end of the previous sentence, was

> inviting him to "come back" and consider revisions to what had already been written. (pp.155-56)

Suggested Interventions

To overcome the problem of premature editing, Marcus and Blau (1983) suggest that the computer itself can be utilized as an "invisible writing" medium. By adjusting the contrast and brightness of the screen, students can type their text without seeing what has already been entered. In doing so, students can concentrate on their flow of thought without the lure to return and evaluate the text previously typed in. After composing, students can then examine their text by merely readjusting the screen display for editing, saving, or printing their work. Marcus and Blau in fact experimented with such a computer-assisted invisible writing environment with three groups of college freshmen. The following remark reflects the response of most of the students after the experiment.

> I can't see what I'm writing, so I don't know if I'm making any mistakes.... and I don't keep going back to correct my errors. That is what takes up a lot of my time when I write. I go over the work I have just written to find my mistakes and in doing this, I end up losing thoughts that I had before I began editing. (Marc & Blau, 1983, p.13)

The researchers, however, caution that such an invisible writing environment may not be suitable for everyone. "For others, losing the opportunity to re-read while writing became so distracting that it obstructed their fluency and interfered with their thinking" (p.13). This is particularly true of writers who compose, plan and/or revise simultaneously. These writers need immediate, visual access to what has already been written in order to develop their thoughts and to refine their ideas. Whether the invisible writing or regular computer writing environment is adopted, it is important for teachers to constantly monitor and caution their students against too much attention to surface editing while composing.

Chapter 4

REVISING

Undoubtedly, the ease and flexibility of changing text on the word processor has made it a powerful device for facilitating the revision process. Without going through the drudgery of copying and recopying, users can easily make numerous changes to their original drafts at various levels - surface editing, addition, deletion, and re-arrangement of ideas. For instance, the electronic cut-and-paste mechanism allows writers to refine and re-organize their ideas for a better flow or for an intended audience. The various editing capabilities can thus encourage students not only to revise more, but also allow them to make large-scale organization changes beyond surface editing (MacArthur, p.537; Balajthy et al., 1986-87; McGarvey, 1986). Again this complies with the Ministry guideline that "revising comes first on the content level, not on the language-usage and mechanical levels" (Ontario Ministry of Education, 1982, p.13).

Observed Behaviours

While research on word processing and writing process in general is scarce, there are a number of empirical studies which examined specifically the effects of word processing on revisions. The research covers a wide range of users - LD children, grade 5 through secondary school students, graduate degree candidates and professional writers. Because of the relatively rich source of data, this chapter will examine in greater detail the ways word processing affects the revision process by first focusing on the amount and frequency of revision, and then on the different levels of revision in turn.

Amount of Revisions

A number of our teacher observers noticed that some of their students did not seem to have made more revisions to their first drafts on the computer than when they wrote in longhand. For instance, a teacher noted that with her intervention, students were picking up

more errors; but the revisions were still limited. "With or without teacher intervention/ instruction, those students who edited carefully on paper were the same students who edited carefully on the computer." In general, she found her students made little attempt to re-word, revise or expand on the language used. Another teacher even found that some of her LD students were reluctant to make even mechanical changes to their text because they liked the way their writing "looked" on the screen. The LD students in MacArthur and Graham's study (1987) also did not seem to revise more on the computer than with pen and paper. They made approximately the same number of revisions (20 per 100 words) in both the handwriting and the word processing conditions.

As for the regular classroom students, Morton, Lindsay and Roche (1989) noted that the frequency of revision on the word processor differs according to students' age level. For instance, it was found that the higher grade level students (grades 7 and 8) who used word processing did produce more drafts after the initial writing than those who worked on paper. However, little or no significant difference occurred for the lower grade students, especially the grade 5's. For the latter, the number of drafts produced via word processing was about the same as it was for those who used pen and paper.

In Daiute's study (1986), her grade 7-9 subjects also corrected more errors on the computer than under the handwriting condition. It should, however, be noted that most of the corrections were made at the composing stage. As a result, during revision, the students made significantly fewer changes on the computer than when they worked with pen. It seems that with word processing, students tend to shift the timing of editing forward from the revision to the composing stage.

As for experienced and professional writers, Lutz (1987) and Bridwell-Bowles et al. (1987) reported that they revised more frequently on the computer than with pen and paper or the typewriter.

The above results demonstrate that older students and experienced writers do make more frequent changes to their texts with word processing. However, the same increase is not evident among younger students or special needs students, regardless of the media employed.

Levels of Revision

According to both our primary and secondary data sources, the most notable kinds of modifications made via the computer are those related to surface adjustments and text

expansion, while higher-level revisions, such as re-organization of texts, do not occur as frequently as expected.

(1) Surface Editing

Surface-level adjustments refer to corrections of mechanical errors in spelling, punctuation, capitalization, or word change - changes that do not affect the meaning of what has been written. One of our teacher observers noticed that when computers were used her students were more likely to pay attention to 'mechanics' of writing or editing than when writing longhand.

Morton et al. (1989) indeed reported that the higher incidence of revision observed among their grade 6-8 students was mostly due to the increase in meaning-preserving revisions - mainly spelling and, to some extent, formatting and paragraphing. Daiute (1986) also found that with word processing her grade 7-9 subjects made more changes in spelling, mechanics, and syntax problems in the text than they did with pen. As a result, the text revised on the computer included significantly fewer errors than when revised under the handwriting condition.

Similar types of revision pattern were also noted among experienced and professional writers. According to Lutz (1987), most revisions made on the computer were at lower linguistic and more localized level, such as word substitution and other surface level changes.

(2) Adding Text

With word processing, another prominent kind of change made during the revision stage is increasing the length of the original drafts. For instance, a teacher observed that some of his students produced a very long piece by retrieving the previous story and expanding on it, whereas in the handwriting condition the story would be significantly shorter. Another teacher noted that one of her LD students "... keeps wanting to add to it [the same story] on the computer - however little gets written." MacArthur and Graham (1987) also noticed that their LD subjects took advantage of the text-editing operations for inserting new material. As a result, all of the stories generated on the word processor became longer following revision, while only half of the handwritten stories were longer.

Similar revision behaviours (i.e. increasing the quantity of text produced) were evident among the grade 5-8 students in Morton et al. study (1989) and the grade 7-9 subjects in Daiute's (1986). In both studies, the researchers however noted that the additions made were limited in two respects. First, Morton et al. realized that although their subjects tended to

insert new texts on the computer, the added texts were mainly of meaning-preserving types. On the other hand, Daiute noticed that the new texts were usually added onto **the end of the file**, even though the additions were related to ideas that could have been developed more fully in the main body of the text. In describing her subjects' revision behaviour, Daiute writes, "... the word processing program made it easier for students to skim their drafts and then 'improve' their drafts by adding words to the end" (p.158).

(3) Deleting Text

Interestingly, while students often use the electronic editor to lengthen their writing, they are less willing to delete text from their original drafts. For instance, when preparing and revising their stories on paper, the grade 5-6 LD students in MacArthur and Graham's study (1987) were more likely to delete textual material; but the reverse is true when word processors were used. The observations of some of our teachers support this finding. For instance, a teacher found that while his students were willing to correct the spelling, they were reluctant to "scrap" what they had composed. "Kids don't want to edit out anything. Length of story gives status to the writer. Editing is a weak area for grade 5-6 students." Morton et al. (1989) also noted that text deletion is a low frequency revision characteristic among their elementary school subjects, although the grade 8 subjects did show "an increase in meaning-changing deletion revisions during the word processing session."

Even among experienced and professional writers, text deletion occurred less often in the word processing mode than in the pen-and-paper mode (Lutz, 1987). Some of the writers in the Bridwell-Bowles et al. study (1987) reported during interviews that they felt less free to abandon text on the computer than when they prepared their drafts on paper (even though by their last computer session all writers deleted lines far more frequently on the computer than they had deleted sentences as they wrote manually). As one of the writers put it, "The computer has a tendency to make you want to salvage too much."

(4) Higher-order Revisions - Rearrangements

Another type of revision which students seldom undertake despite the facilities offered by the computer is within-text revision, such as re-arranging or re-organizing ideas or a body of text with the use of cut-and-paste mechanism. As pointed out by one of our teachers, "Little attempt was made by students to do any extensive editing, e.g. moving sentences, setting up paragraphs. Editing on computer still seems limited to correcting spelling errors primarily." Although she encouraged her students to "cut and paste" on the computer, the idea was not received enthusiastically. "It was observed that most pupils were satisfied with the

way the story looked in its final version and were unwilling to cut it up, and paste it together again." In other words, her students wanted to keep the look and the length of their original writing, and were reluctant to delete or re-organize their text.

MacArthur and Graham (1987) also mentioned that their LD students were unable to take full advantage of the text-editing capabilities to insert a sentence in the middle of a paragraph or to relocate a block of text. They found that in both the word processing and the pen-and-paper modes, their LD students made similar proportions of substitutions, additions, and rearrangements, and hence did not differ in the proportion of revisions that changed textual meaning.

As for the regular classroom students, Morton et al. (1989) noted that while grade 6-8 students did increase their revisions at the surface and localized level in the computer mode, higher order revisions - revisions that would alter the meaning and/or gist of the text - did not occur more in word processing condition than in pen-and-paper condition. It seems that students in general fail "to make use of the sophisticated text manipulation features which make word processors powerful tools for expert writers" (Smye, 1988, p.44).

Even among experienced and professional writers, Lutz (1987) noticed that changes made beyond word or sentence level - for example, multi-sentence, section, and idea changes - were limited. Indeed, in the pen-and-paper condition her subjects reordered the body of the text proportionately more than in the word processing condition, though the differences were not statistically significant.

Ragsdale's reflection on his own word processing experience reiterates the point.

> ... given the presence of the first draft on a word processor, my response would have been to "work around" that draft, leaving as much of it as possible in its original form, doing most of the revision in the form of additions, with only minor changes made to the existing text. What this means is, though word processors offer extremely powerful tools for revision, they are effective only if you know how to use them to make revisions, and my own personal experience has been that they can inhibit the extent of my revisions.... (Ragsdale, 1988)

The above findings correlate with Roblyer and her colleagues' recent research review report (1988): "The general trend ... was that word processing use had little impact on the number of revisions or on increasing the quality of revision strategies, although it did tend to increase the number of words per composition that students produced" (p.103). The findings also comply with the point made by Balajthy et al. (1986-87):

> After several years researching the effects of word processors in the classroom, educators have found that students do not automatically engage in such in-depth experimentation .... While there is a statistically significant difference in the amount of writing and revision done by children using word processors than by those using pencils, this difference is often so small that it is of little educational significance. Instead of thoughtfully analyzing and revising composition structure, students using word processors will often limit their changes to superficial, mechanical alterations .... (p.28)

Discussion

There may be several reasons for the overall lack of substantive revision despite the powerful editing functions offered by the computer.

(1) Developmental Factors

Perhaps one of the reasons for students', especially younger students', failure to revise more on the computer has to do with the developmental factor. It is highly possible that younger students are not able to manipulate the more advanced editing functions, such as cutting and pasting, offered by word processors. The Morton et al. study (1989) clearly shows that the effects of word processing on students' revision process varied according to the students' grade levels. For the grade 5 students, word processing seemed to have the least impact on their revision behaviour, although it did encourage them to increase text length. According to the researchers, these students may be too young to take advantage of the more sophisticated or advanced word processing functions. On the other hand, grade 6 students did benefit from the use in terms of text expansion, spelling, formatting, and other meaning-preserving types of revision. For the higher grade level students (grades 7 and 8), the effects of word processing on this level of revision seemed less notable again because these students were proficient at this level of revision regardless of the medium used.

(2) Lack of Revision Strategies

Another possible reason that has often been suggested by writing experts or researchers is the lack of revision strategies among students. It has been maintained that even with the operational knowledge, students may still fail to tap the computer editing facilities because they are not familiar with the revision strategies themselves, especially the higher order ones.

Two parallel studies by Kurth (1986,1987) may shed some light on this argument. In both studies - one for grade 9 students (1987), and the other for grade 10 and 11 (1986), Kurth

examined how word processing coupled with intensive training in writing strategies can affect these students' revision process. In both studies, the subjects were students who enrolled in a special class for interested writers. Hence, these subjects were likely to be more interested in writing and to be better writers than their average peers. The results show that after intensive training in writing processes, students in both the control and the word processing groups undertook substantial revision, and there were no significant differences between the two groups in terms of the number and the type of changes made. For both groups, significant improvements were evident in the quality of the compositions involving global adjustments, in which sentences or paragraphs were re-arranged or re-oganized. This shows that the more sophisticated revision behaviour had much to do with the fact that students were taught revision techniques in the classes and were strongly encouraged to adopt the strategies in their revision. "... the instruction in global revision given in both classes probably did more to stimulate global revisions than did the use of the word processor" (Kurth, 198 , p.8).

While the lack of revision strategies may deter students from performing high-level revisions, there are also computer-related factors that may impede the process.

(3) "No Re-copying or Re-typing"

Although word processing has the the advantage of freeing one from the mechanical burdens of re-copying or re-typing during revision, this very benefit seems to have two side effects. First, as a result of relieving students or writers from the "copying over" tedium, there is a desire for them to preserve what has originally been created. Consequently, students or writers were more likely to tinker than to "re-vision" or re-read their drafts closely for thorough revision:

> ... when faced with a defective sentence, my first and strongest response is to look for the smallest possible wording change to bring it back to health. The same is true for paragraphs or sections, a logical extension perhaps, of the notion that word processing can save effort through avoidance of retyping. (Ragsdale, 1988, p.155)

The other possible side effect of eliminating the need for re-copying is suggested in Daiute's study (1986). The very physical act of re-copying or re-typing requires "that the writer interact more closely with the text than he or she does when there is no reason or guidance to read the text" (p.154). Without the need to re-copy or re-type on the word processor, students or writers are likely to have less physical interaction with the text. For the less experienced writers, this elimination of certain physical aspects of revising reduces their chance to re-evaluate their initial work closely.

> When the burdens of recopying were lifted, student writers tended to interact less with what they had written in a draft than they did when they revised with pen and had to recopy. It appears that these students skimmed over their texts enough to catch mechanical errors but not enough to rework the text at any higher level. (p.153)
>
> The new type of revising by adding to the end of the text seems to be an artifact of a writing instrument that relieves the burden of recopying. And it indicates that recopying is not the meaningless process it appears to be. Recopying could be useful because it slows the writer down during the text evaluation process and leads the writer to focus on each word. As a matter of fact, one prize-winning writer explained that he prefers to retype his drafts rather than use the word processor because when retyping he has to confront and evaluate each word.... (p.156)

Bridwell, et al. (1984) have expressed a similar concern: "... the writer without access to a word processor may, in some ways, be better off. The admittedly mechanical 'editing' capabilities of a text processing system, **especially when a student is given no guidance** [emphasis added] as to how these individual functions could be used in a comprehensive revision of the subject, may induce the student to produce less coherent text than his non-processing peers, text that is not much rewritten as it is manipulated" (p.382).

(4) Difficulty of Reading Text on the Screen

While experienced writers may overcome some of the subtle effects discussed above, the hardware itself does have some inherent restrictions to undertaking extensive and global revision on the screen. One of the inhibiting factors is the difficulty of reading text on the monitor screen (Haas & Hayes, 1986, Bridwell et al., 1984; Ragsdale, 1988; Haas, 1987; Lutz, 1987). First and foremost, it has been widely known about the eye strain problem associated with reading text on the video screen for an extended period of time. In fact, earlier human factors research has already indicated that reading is slower or less efficient on the computer (Haas & Hayes, 1986).

Furthermore, a major difference between video screens and paper is that the former can only display a limited amount of text at a time, while the latter can be spread out as needed. With the limited screen size, users can only scroll forward and backward in smaller chunks than they can with pen and paper. Reading from the video screen, as a result, may give a discontinued or fragmented impression of a piece, making it harder to view and analyze the overall composition structure.

- "I have a hard time reading my writing objectively on the screen" (Haas, 1987).
- "It's hard to get a sense of the text" (Haas, 1987).

- "I tended to see this [writing assignment] in discrete units ... not the continuity of the whole piece" (Lutz, 1987).

In fact, Haas and Hayes (1986) conducted three experimental studies with college students. The results show that when reading on the screen, the students had difficulties in locating information, detecting errors, and reading their texts critically. According to the researchers, "visual/spatial factors influence locational recall, information retrieval, and appropriate reordering of text" (p.22). Hence, there is a tendency for writers to focus more on localized adjustment on the screen but not global changes. As Lutz puts it, "the word processor encourages concentration on the smaller domains of a text by making lower level changes easy [but] structural changes more difficult" (p.419). On the other hand, the hardcopy condition offers a better sense of continuity in the written drafts. As a secondary student commented in an interview with Parson (1985), "I'd change little things like spelling right on the screen, but I'm still more comfortable with dealing with idea things on paper" (p.41).

Suggested Interventions

While the above discussion attempts to explain why high-level revision does not occur automatically on the computer, it does not deny the fact that the word processor can facilitate the process. There are indeed several ways in which teachers can try to encourage their students to attempt higher order revision with the computer.

On-line Editing Exercises

First, students need to be explicitly taught, guided, and reminded on (i) how to revise thoroughly (regardless of the medium used), and (ii) how to use the word processor for thorough revision. Direct instruction on both revision strategies and word processing skills are essential to promote effective revision behaviour. Some writing experts suggest that these learned skills can be reinforced with the computer. An example is the commercially available software editing exercises. In these exercises, students are required to review the given text and to use the various editing functions to perform different levels of text adjustment, such as "deleting letters and words, correcting misspelled words, ordering sentences in paragraphs, replacing words, inserting punctuation, combining sentences and ordering paragraphs" (Balajthy et al., 1986-87, p.30). These exercises serve two purposes: (i) exposing students to various ways of revising text, and (ii) training them to use different editing functions to make changes at different levels.

According to Balajthy et al. (1986-87) and Oates et al. (1987), teachers themselves can develop similar exercises on the word processor to reinforce the kinds of revision that their students tend to omit. For instance, teachers can create a file that includes paragraphs of expository text with the sentences input in random order. Students read the paragraphs and re-arrange the sentences using the word processor's MOVE commands. Another example is a file containing a sample composition in which connectives and transitions are missing. Students are then required to insert these items to provide structural coherence to the composition.

Style-Checkers

Aside from on-line exercises, there is another type of specially designed programs which may assist students with the actual revision process. They are the text parsers or style checkers, which are software tools designed for basic editing and revising. The program performs some routine checking and parsing of the text submitted and produces a file containing the analysis of spelling, punctuation, simple sentence structure (e.g. the use of passive voice, "to be" verbs), and the readability level of the piece (Oates & Oates, 1987). Some advocates find this tool useful in that it releases teachers from routine checking and allows them to pay more attention to content and organization.

However, as some writers point out, these text parser programs may be more suitable for experienced writers such as graduate students who make few mistakes than for less experienced writers (Hansen & Wilcox, 1984; Strickland, 1988). For the latter, pages of elaborate printout of their style-analysis can be intimidating. Students could be at a loss as to how to revise their text. There is also a danger of being "slave to the program's suggestions" with the computer being "an arbiter rather than a tool" (Hansen & Wilcox, 1984). Furthermore, such parsers stress the surface features of the text, which works against viewing writing as a process.

Strickland (1988) suggests an alternative method that uses the word processor's search-and-replace function to simulate style-checking software. For instance, with the search command, students can be asked to locate one at a time such fuzzy words as "very", "really", or "quite" that appear in their essays. Students then decide whether to change or keep the word before going on to the next search. The same procedure can be repeated for checking, for example, excessive use of "which" phrases. Through their own search and replace operations, students make conscious effort to improve the style of their text. This strategy for revision, according to Strickland (1988), "keeps the writer in control."

Revision Prompting Programs

For encouraging high level revisions, on-line prompting programs are available (Smye, 1988). These special programs are designed to help students or writers re-consider and reflect on their own writing objectively by presenting a set of prompts. The prompts, usually in the form of interactive questions, either suggest a revision technique, or require users to think about the text in terms of "completeness, clarity, organization, coherence, sentence structure, and punctuation" (Daiute, 1986, p.146). For example, the question "Does this paragraph make a clear point?" will appear under a paragraph when the user selects an option related to clarity. The intent is to suggest a "self-reflective questioning strategy" for users. Curtis (1988) called these "heuristic devices" which "can in themselves prompt students to make the sort of meaningful - not just superficial - revisions they've habitually failed, refused, or neglected to make with the traditional implements of writing" (p.339).

Daiute in her study (1986) experimented with a self-question prompting program, and found that students with the prompting program made significantly more revisions on the computer than those students without the program. The students with the prompting program also read and evaluated their text more closely, and thus used the word processing features to a greater extent to perform more interactive and global types of revisions. "... the prompting questions engaged the students in reading over and critiquing their texts."

Computer Strategies for Teaching Revision

While revision prompting programs may be a helpful aid for intermediate level students, the on-line interactive questions may be too restricted or too general for more senior level students. Strickland (1988) in his paper offers several strategies for teaching high level revision with the word processor itself. Drawing upon the editing capabilities of the word processor, these strategies aim at promoting such revision activities as re-seeing, re-organizing, elaborating, trimming, and strengthening what has already been written - types of revisions that are seldom attempted by students.

For example two of the strategies suggested are "Outlining" and "Stairway of Elaboration". The first strategy requires students to find the Most Valuable Sentence (MVS) in the essay and copy it to the top of the page to serve as the theme of the piece. Then they create and insert a heading for each paragraph. The theme and headings will become an outline structure of the draft, with which students themselves can easily spot "leaps of logic and missing transitions". With the outline, the second strategy, "Stairway", requires students to add and/or delete sentences and paragraphs in order to further explain the theme or the individual headings, or to improve the overall flow and development of the piece.

These two strategies as well as others discussed in Strickland's paper are intended to teach students using the word processor to re-see and revise the structure of the text - for example, to move and rearrange blocks of text, to elaborate within sentences and paragraphs, to insert text, to rework sentences, and to delete (trim), rather than simply adding to the end of the text, substituting words, correcting punctuation, grammar and spelling.[5] According to Strickland, all these activities can also be implemented on the computer as lesson files.

Pen and Computer Hardcopy

Finally, it should be remembered that pen and paper - in this case computer printouts - also have a part to play in the revision process. As discussed earlier, limited screen display seems to deter one from reading one's text critically and objectively. Even experienced computer writers need to print out their text in order "to read critically, to proofread and make objective assessments of the text, and to see how parts of the text fit together" (Haas and Hayes, 1986, p.25). However, teachers should be cautioned that for some students, especially the younger ones or those who lack revision strategies, the neat printed hardcopy looks so polished that it does not seem to need any revision (Strickland, 1988). As mentioned earlier, one of our teachers noted that her students were reluctant to revise their stories and were happy with the way the text appeared on the screen or on hardcopy. On the other hand, for students who are capable of revising at a higher level, the neatly-typed form has an advantage over handwritten drafts in that "it brings things out more clearly" (Parson, 1985, p.43), thus allowing students to detect mechanical errors as well as idea or structural lapses more easily. Furthermore, it is likely that one reads a printed text more objectively than a text in one's own handwriting (Parson, 1985; Daiute, 1986). With the printouts, students can then correct or refine their text by writing right on the hardcopy. Hence, teachers should make printing readily available to their students, and should encourage students to read, evaluate, and revise their text on hardcopy, and use the electronic editor for executing the physical change.

Indeed, allowing students to work on and off the computer during the revising stage may have an additional benefit. Being away from the word processor, students are forced to concentrate on revising their writing, and are not tempted to fix the text on the screen before they have the chance to reflect on the whole composition. Of course, revision can be a repeated process involving several rounds of re-seeing and revising. Therefore, an effective computer writing environment may be one in which students can easily work on and off the computer as needed.

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5. For more details about the various strategies, refer to Strickland's article.

Chapter 5

TEACHERS' INPUT IS IMPORTANT

> Most attempts at innovation introduction concentrate on the benefits to be realized with the implicit assumption that, once the benefits are seen, adoption is an unproblematic matter of welcoming the innovation with open arms and working to become proficient with it. (Durell, 1990, p.1)

There is no doubt that word processing is a powerful tool for creative writing. Its motivational value, especially for young students, is well confirmed in the literature. Its editing capability has also made writers feel freer to experiment with their writing. Yet, as discussed in the previous chapters, when used alone and with little input from teachers, its full potential will remain untapped; in fact, some of its effects may be inhibitive to students' text production. For instance, as students become more willing to take risks in starting their writing on the word processor, they tend to cut short or bypass the important stage of overall careful planning and organization of ideas. As well, during the actual composing stage, students are often attracted to tinkering with the surface features of the typed-in text on the screen instead of concentrating on their flow of thought. At the revision stage, adding new texts to the end of the original drafts and fixing surface errors such as spelling or word changes are often attempted, but high-level revision such as re-organizing or re-writing the text is seldom undertaken despite the powerful editing mechanism available on the computer.

It is thus argued that the word processor's capabilities will be under-utilized if students are left to use the word processor on their own with minimal supervision from teachers. It is true that many teachers have played an active role in their writing class - for example, conducting brainstorming or group discussion sessions with students before and after writing. But many teachers may also agree that when it comes to word processing, their involvement in their students' computer writing process is far from comprehensive. There are legitimate reasons for the phenomenon. First, although more and more teachers are using word processing in their writing class, many have only one or two computers at the back of their classroom. It is difficult for them to pay close attention to the few students working on the

computers, while attending to the rest of the class. Furthermore, for many teachers the adoption of word processing in their writing class is relatively recent, and they have not used the system long enough to be familiar or comfortable with it. Their unfamiliarity with the system may have precluded them from being actively involved. According to Hall's concept of Stages of Concern About the Innovation (1979), innovation adoption is a developmental process. Many of our teachers may have already gone through the initial stage in which they have "come to terms with the innovation", and they are now at the early stage of implementation when the major concerns are mostly management-related - for example, getting the machines to work, and scheduling students' use. As a result, their direct involvement in their students' actual word processing and writing process is minimal.

Under such circumstances, the impact of the innovation will hardly be substantial. As has been shown in this paper, simply making word processors available does not necessarily guarantee that students can take full advantage of the technology for improving their writing skills. What is needed is to have teachers advance to yet another stage, in which the concerns are more focused on (i) "how the innovation is affecting learners," and (ii) "how to increase its impact" (Hall, 1979). We have partly answered both questions in the previous chapters by describing the desired as well as the unexpected outcomes of word processing itself for students' writing, and by providing suggestions on how to increase the impact for each writing stage. Yet, it is still worth reiterating the point that, in addition to exposure to the technology, teachers' interventions along with new strategies for teaching writing with the computer are crucial. Rather than freeing teachers from involvement in their students' process of text production, as indicated in the earlier chapters, the use of word processing offers teachers greater opportunities to play an active and innovative role in enhancing their students' creative writing skills. The teacher's role as an instructor and a facilitator remains instrumental.

Teachers as Instructors

Word processing, in itself, does not teach students how to write. Students with incomplete revision strategies will not begin revising at a higher level simply by using a word processor. Teachers' direct instruction in writing strategies - for example, through modelling experts' writing process, demonstrations, group discussions, strategy charts, etc. - are still important to give students knowledge and skills (Strickland, 1988). As Balajthy et al. (1986-87) write, "Word processing must supplement writing instruction, not replace it. Teachers still need to teach students the writing process, guide their construction of

compositions and provide feedback helpful for revision" (p.28). In fact, several recent computer writing studies have demonstrated that after intensive training sessions in writing, students (ranging from elementary school LD students to secondary school students) made substantial improvements in their writing and revision skills on the word processor, even though in some cases computers were not employed during training (Graham & MacArthur, 1988; Kurth, 1986; Kurth, 1987).

Aside from teaching writing processes, teachers also need to ensure that their students have mastered the necessary keyboarding and word processing skills. Students, especially the younger ones, may not be able to figure out for themselves how to utilize the technology to its fullest. Therefore, rather than spending a brief period introducing the basic inserting and deleting functions, teachers should actively teach, train and encourage their students to use other more advanced editing functions, such as searching, replacing, cutting and pasting, etc. (Oates & Oates, 1987; Hansen & Wilcox, 1984).

Teachers as Facilitators

Another important condition for fostering an effective computer writing environment is having teachers act as facilitators through constant monitoring of their students' word processing and writing process. Rather than leaving students to work at their terminals on their own, according to many writing experts, teachers' direct involvement throughout the course of computer writing is vital (Morocco & Neuman, 1986; Balajthy et al., 1986-87; Oates and Oates, 1987; Curtis, 1988). With the upright monitor and clear print, the word processor indeed affords teachers more opportunities to interact with and facilitate their students' writing activities. For instance, teachers can observe and, if necessary, coach, prompt and raise questions to provide help with difficulties, to clarify ideas, and to reinforce student decisions (MacArthur, 1988; Morocco & Neuman, 1986). Of course, one should be cautioned that the easy access to the students' writing process should not lead to intrusion into or control and ownership of the students' writing process (Morocco & Newman, 1986). For example, questions raised to the students should be open and non-directive (Curtis, 1988). As noted in MacArthur's study (1988), "students' motivation and sense of ownership of their writing were enhanced when teachers provided procedural support, or help in how to approach writing tasks, rather than giving substantive help with content" (p.537).

Conclusion

To recapitulate, the word processor is an effective tool for promoting students' creative writing. It is well documented that with the computer, students are more motivated to write; they are more willing to take risks in their writing; they tend to produce longer text; they edit more and thus produce fewer surface errors; and they are proud of the neatly printed copies of their writing. These effects alone are sufficient evidence that word processing is beneficial to students' writing. However, it is strongly believed that this advanced technology has greater potential than those benefits just mentioned. Potentially, it can enhance students' overall quality of writing. For instance, with word processing, students should be able to concentrate more on the ideas, content and their train of thought during composing and leave the mechanical and formatting part of their writing to a later stage. In addition, the flexible editing functions of the word processor can facilitate large-scale revision - for example, re-organizing the flow of the text - without the need to go through the drudgery of the re-copying process.

This study, however, demonstrates that in order to tap the full potential of the technology for enhancing students' writing skills, several conditions need to be met. First and foremost is **teachers' active involvement in the process** both as instructor and facilitator. As pointed out earlier, students need instruction and guidance in writing strategies as well as word processing skills to apply the strategies learned. To facilitate students' computer writing process, teachers have to constantly monitor students' interactions with the computer - for example, cautioning their students against the distraction of premature editing while composing, or prompting students to revise the computer-generated text beyond the surface level.

Another important condition is that the word processor should be employed in conjunction with, rather than in place of, **other writing tools**. For instance, when careful planning is necessary in such cases as report preparation, pen and paper may be a more convenient medium than the word processor for jotting down, crossing out, listing, or charting preliminary ideas or rough notes. When revising, pen and computer hardcopy seem to allow students to read, evaluate and revise their drafts more closely, thoroughly, objectively, and efficiently than with the keyboard and the screen. It is thus important to make printing easily accessible to students especially during the revision process. Aside from pen, paper and printers, there are computer writing tools specially designed for students who need help in generating or organizing their ideas before writing, or in revising their text after writing.

The third requirement is **availability of sufficient hardware**. Teachers have to have access to enough computers (and printers) in order to ensure that the word processor can be fully integrated into their writing class rather than being simply an add-on piece of equipment in the classroom. Otherwise, it is difficult for teachers to pay close attention to the few students who work on the computers while attending to the rest of the class. Having writing lessons at a computer lab may be a viable option because computer writing can then become a major classroom activity and teachers can spend more time on and be more actively involved in their students' word processing and writing process. For some elementary school teachers, computer labs may not be readily available, or multiple group activities may be more desirable than a single class activity. In those cases, one or two more computers and/or a printer may also be helpful in enabling teachers to create a small-scale computer lab as an activity centre within the classroom. Teachers may then spend a block of time in their regular class period with the group of students who are working on the computers.

Last but not least, **teachers themselves need to be supported and facilitated**. For instance, teachers, particularly novice users, have to have time to familiarize themselves and experiment with the system. They also require information on and training in how to increase the impact of the technology on their students' learning. It is hoped that this study will serve as one source of information for teachers who are interested in using the computer as a tool to foster the creative process of writing for their students.

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